

WHAT IS CLAIMED IS:

1. A pattern inspection apparatus to inspect  
pattern defects of a substrate in which a pattern is  
formed comprising:

5           an illumination optics which applies a first  
inspection light on a predetermined wavelength to a  
surface opposite to a pattern formed surface of the  
substrate, and applies a second inspection light whose  
wavelength is equal to the predetermined wavelength  
10          of the first inspection light to the pattern formed  
surface;

15          a detector which selectively detects a transmitted  
light from the substrate by irradiation of the first  
inspection light and a reflected light from the  
substrate by irradiation of the second inspection light  
so as to perform a transmitted-light-based inspection  
and a reflected-light-based inspection; and

20          a space separation mechanism which is provided in  
the vicinity of an optical focal plane toward the  
pattern formed surface of the substrate, and spatially  
separates an irradiation area of the first and the  
second inspection light such that the transmitted light  
and the reflected light from the substrate are imaged  
in two discrete areas separated on the optical focal  
25          plane.

2. The pattern inspection apparatus according to  
claim 1, further comprising: a first detection optics

which leads the transmitted light separated by the space separation mechanism to the detector; and a second detection optics which leads the reflected light separated by the space separation mechanism to the 5 detector.

3. The pattern inspection apparatus according to claim 2, wherein the first detection optics and the second detection optics independently change a magnification for an observed image, and change an 10 illumination area of the illumination optics in accordance with the magnification thereof, respectively.

4. The pattern inspection apparatus according to claim 1, wherein the illumination optics has a 15 polarizing beam splitter provided between the pattern formed surface of the substrate and the space separation mechanism, and the polarizing beam splitter reflects the second inspection light to lead the second inspection light to the pattern formed surface of the substrate, and lets the transmitted light and the 20 reflected light from the substrate pass through.

5. The pattern inspection apparatus according to claim 1, wherein the illumination optics has a 25 polarizing beam splitter provided between the space separation mechanism and the detector, and the polarizing beam splitter transmits or reflects the second inspection light to lead the second inspection

light to the space separation mechanism, and reflects or lets through the reflected light from the substrate obtained via the space separation mechanism to lead the reflected light to the detector.

5       6. The pattern inspection apparatus according to claim 1, wherein the optical focal plane toward the pattern formed surface of the substrate is at least a magnification focal plane of an observation field observed in the pattern formed surface, and a mirror is  
10      used as the space separation mechanism, and the mirror is fixed at a position offset from the optical focal plane.

15      7. The pattern inspection apparatus according to claim 1, further comprising an XY stage on which the substrate is mounted, and which moves in an XY direction of a plane vertical to an illumination light axis, wherein one axis of the XY stage is sequentially moved to obtain a pattern image, and a TDI sensor of a charge accumulation type is used as a detection sensor of the detector, and the number of accumulation steps of the TDI sensor for the transmitted-light-based inspection is different from that of the accumulation steps of the TDI sensor for the reflected-light-based inspection.  
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25      8. The pattern inspection apparatus according to claim 1, wherein the illumination optics has a single light source.

9. A pattern inspection apparatus to inspect pattern defects of a substrate in which a pattern is formed comprising:

5        a first illumination optics which applies a first inspection light on a predetermined wavelength to a surface opposite to a pattern formed surface of the substrate;

10      a first detection sensor which detects a transmitted light from the substrate by irradiation of the first inspection light, for a transmitted-light-based inspection;

15      a second illumination optics which applies a second inspection light whose wavelength is equal to the predetermined wavelength of the first inspection light to the pattern formed surface of the substrate;

20      a second detection sensor which detects a reflected light from the substrate by irradiation of the second inspection light, for a reflected-light-based inspection; and

25      a space separation mechanism which is provided in the vicinity of an optical focal plane between the pattern formed surface of the substrate and the first and the second detection sensor, and separates the transmitted light and the reflected light from the substrate such that the transmitted light and the reflected light are imaged in two discrete areas separated on the optical focal plane.

10. The pattern inspection apparatus according to  
claim 9, further comprising: a first detection optics  
which leads the transmitted light separated by the  
space separation mechanism to the first detection  
5 sensor; and a second detection optics which leads the  
reflected light separated by the space separation  
mechanism to the second detection sensor.

11. The pattern inspection apparatus according to  
claim 10, wherein the first detection optics and the  
10 second detection optics independently change a  
magnification for an observed image, and change  
illumination areas of the first illumination optics and  
the second illumination optics in accordance with the  
magnification thereof, respectively.

15 12. The pattern inspection apparatus according to  
claim 9, wherein the second illumination optics has a  
polarizing beam splitter provided between the pattern  
formed surface of the substrate and the space separa-  
tion mechanism, and the polarizing beam splitter  
reflects the second inspection light to lead the second  
20 inspection light to the pattern formed surface of the  
substrate, and lets the transmitted light and the  
reflected light from the substrate pass through.

25 13. The pattern inspection apparatus according to  
claim 9, wherein the second illumination optics has a  
polarizing beam splitter provided between the space  
separation mechanism and the second detection sensor,

and the polarizing beam splitter transmits or reflects  
the second inspection light to lead the second  
inspection light to the space separation mechanism, and  
reflects or lets through the reflected light from the  
5 substrate obtained via the space separation mechanism  
to lead the reflected light to the second detection  
sensor.

14. The pattern inspection apparatus according to  
claim 9, wherein the optical focal plane toward the  
10 pattern formed surface of the substrate is at least a  
magnification focal plane of an observation field  
observed in the pattern formed surface, and a mirror is  
used as the space separation mechanism, and the mirror  
is fixed at a position offset from the optical focal  
15 plane.

15. The pattern inspection apparatus according  
to claim 9, further comprising an XY stage on which  
the substrate is mounted, and which moves in an XY  
direction of a plane vertical to an illumination light  
20 axis; wherein one axis of the XY stage is sequentially  
moved to obtain a pattern image, and TDI sensors of a  
charge accumulation type are used as the first and the  
second detection sensor, and the number of accumulation  
steps of the TDI sensor for the transmitted-light-based  
25 inspection is different from that of the accumulation  
steps of the TDI sensor for the reflected-light-based  
inspection.

16. The pattern inspection apparatus according to claim 9, wherein the first and the second illumination optics share a single light source.

5       17. A pattern inspection apparatus to inspect pattern defects of a substrate in which a pattern is formed comprising:

10            a first illumination optics which applies a first inspection light on a predetermined wavelength to a first area of a pattern formed surface of the substrate;

          a first detection sensor which detects a transmitted light from the substrate by irradiation of the first inspection light;

15            a second illumination optics which applies a second inspection light whose wavelength is equal to the predetermined wavelength of the first inspection light and whose polarizing direction is different from that of the first inspection light, to a second area, which is separated from the first area, of the pattern formed surface of the substrate;

20            a second detection sensor which detects a reflected light from the substrate by irradiation of the second inspection light; and

25            a polarizing beam splitter which is provided in the vicinity of an optical focal plane between the pattern formed surface of the substrate and the second detection sensor, and reflects or transmits the first

and the second inspection light to send to the pattern formed surface of the substrate, and transmits or reflects the reflected light from the substrate to send to the second detection sensor.

5       18. The pattern inspection apparatus according to claim 17, further comprising: a first detection optics which leads the transmitted light to the first detection sensor; and a second detection optics which leads the reflected light to the second detection  
10      sensor.

15      19. The pattern inspection apparatus according to claim 18, wherein the first detection optics and the second detection optics independently change a magnification for an observed image, and change illumination fields of the first illumination optics and the second illumination optics in accordance with the magnification thereof, respectively. ....

20      20. The pattern inspection apparatus according to claim 17, further comprising an XY stage on which the substrate is mounted, and which moves in an XY direction of a plane vertical to an illumination light axis; wherein one axis of the XY stage is sequentially moved to obtain a pattern image, and TDI sensors of a charge accumulation type are used as the first and the second detection sensor, and the number of accumulation steps of the TDI sensor for the transmitted-light-based inspection is different from that of the accumulation  
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steps of the TDI sensor for the reflected-light-based inspection.

21. The pattern inspection apparatus according to claim 17, wherein the first and the second illumination optics share a single light source.